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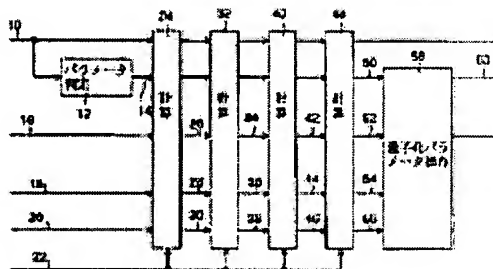
(54) CODE QUANTITY CONTROLLER

(57)Abstract:

PURPOSE: To improve the coding efficiency by using a deficient code quantity by a quantization device when the quantizer satisfying an object code quantity is selected and using an excess code quantity by a quantization device whose quantization width is smaller by one step so as to approach the code quantity to an object code quantity.

CONSTITUTION: A calculation section 32 executes calculation of a code quantity by an input quantization number 26 and the result revises deficient/excess data 28, 30, and the result is outputted to a next stage as deficient/excess data 36, 38. The operation is repeated by four stages to obtain final deficient/excess data 54, 56. That is, let a quantization number 52 decided finally be Q_n , a caption 54 indicates deficient data quantity in the case of coding by the Q_n and a caption 56

indicates a data quantity in excess when coded by a number Q_n-1 . A quantization parameter operation section 58 uses deficient/excess data to control a quantization parameter 50 to command the use of a quantization device shifted from the Q_n in the unit of small blocks for the selected Q_n to attain fine-adjustment of the code quantity.



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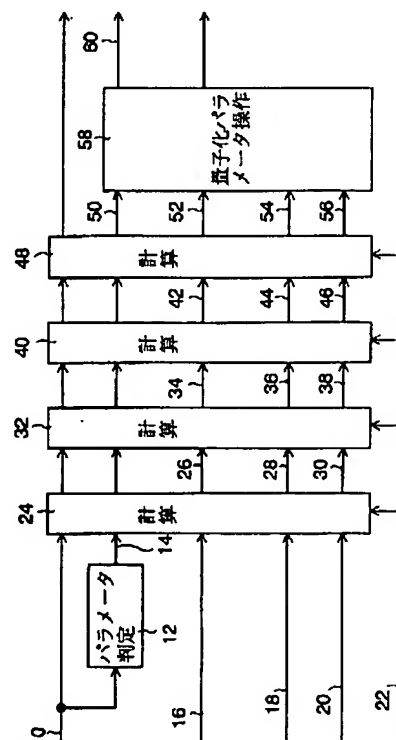
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(54) 【発明の名称】 符号量制御装置

(57) 【要約】 (修正有)

【目的】 目標符号量を満たす量子化器Q₀が選択されたとき、更に目標符号量に近づけ符号化効率を改善する。

【構成】 複数の量子化器から目標符号量以下になる量子化器を2分探索で決定する際に、その不足データ量と、符号量が目標符号量より多くなる1つ隣の量子化器による場合の超過データ量を算出し、最終的な不足／超過データ量54／56が得られる。これは最終的に決定された量子化番号52をQ₀とすると、54はQ₀で符号化した場合の、目標符号量22に対する不足データ量を示し、56はQ₀-1で符号化した場合の目標符号量からの超過データ量を示す。この不足データ量と超過データ量を使って、量子化パラメータ操作部58により、量子化パラメータ50を操作し新たな量子化パラメータ60を得て、大ブロック単位に選択されたQ₀に対し、各小ブロック単位にQ₀から相対的にシフトして適用する量子化器を決定する。



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【特許請求の範囲】

【請求項1】 複数の小ブロックからなる大ブロック単位に符号量を一定にする符号量制御装置であって、符号化量を計算する複数段の符号量計算手段と、各段における目標符号量に対する不足／超過符号量を後段に伝達する伝達手段と、当該符号量計算手段の計算結果により、伝達された不足符号量及び超過符号量の何れか一方を更新する更新手段とを具備し、当該符号量計算手段の最終段で得られる当該不足／超過符号量に従い、上記各小ブロック符号化する際の量子化パラメータを操作し、もって発生符号量を当該目標符号量に近付けることを特徴とする符号量制御装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、符号化装置における符号量制御装置に関し、より具体的には可変長符号を用いる符号化装置における符号量制御装置に関する。

【0002】

【従来の技術】図4に従来の高能率符号化装置の概略構成ブロック図を示す。図4において、210は大ブロック化部、212は小ブロック化部、214は直交変換部、216は量子化部、218は符号量計算部、220は量子化器選択部、222は可変長符号化部である。

【0003】画像データは先ず、大ブロック化部210に入力し、ここでいくつかの大ブロックに分割される。この大ブロックは、後述する小ブロックをいくつか集めたものであり、大ブロック単位で符号量が一定になるように符号化が制御される。従って、原画像の情報量を平均化するように、予め画面上でシャッフルされた小ブロックを集めて大ブロックとすることが多い。

【0004】小ブロック化部212は、各大ブロックをいくつかの小ブロックに分割する。この小ブロックは、後述する直交変換の単位となり、縦8画素、横8画素がよく使用される。

【0005】直交変換部214は各小ブロックを直交変換し、その結果（変換係数と呼ぶ。）を出力する。直交変換は例えば、離散コサイン変換（DCT）である。

【0006】変換係数は、量子化部216により量子化されるが、その前に、符号量計算部218が、大ブロック単位での最終的な符号量を計算し、その結果に応じて、量子化器選択部220が、所定の符号量を達成できる、即ち目標符号量を越えない量子化器（又は量子化テーブル）を選択する。符号量計算部218の詳細は後述する。

【0007】量子化部216により量子化された変換係数は、可変長符号化部222により可変長符号化される。具体的には、各小ブロック内の変換係数を低域側からジグザグ走査し、ランレングス符号化したあと、ハフマン符号化する。これらの一連の処理を含めて、本明細書では可変長符号化と呼ぶことにする。

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【0008】符号量計算部218の動作を説明する。N個の量子化器がある場合、予め量子化幅の小さい量子化器から順に1からNの番号をつけ、 Q_n ($n=1\sim N$)で各量子化器を特定することにする。符号量から見ると、 n が小さいほど符号量が多くなる。前述したように、大ブロック単位で目標の符号量に抑えるために、大ブロック毎に1つの Q_n を選択するのがここでの課題である。

【0009】適切な量子化器を決定するのに、例えば2分探索法を使用する。即ち、具体的には、中央の量子化器 $Q_{N/2}$ を選択し、実際に量子化及び可変長符号化を実行して符号量を計算する。その符号量が目標符号量よりも小さい場合、目的の量子化器は Q_1 から $Q_{N/2}$ の間にあるので、その中間の量子化器 $Q_{N/4}$ で同様の計算を繰り返す。逆に符号量が目標符号量よりも大きい場合、量子化器 $Q_{3N/4}$ で同様の計算を繰り返す。このようにして、N個の量子化器がある場合、 $\log_2 N$ 回で目的の量子化器を決定できる。N=16の場合の量子化器の選択過程を図7に示す。図7で、310は符号量が目標符号量よりも小さい場合の選択方向、312は符号量が目標符号量より大きい場合の選択方向をそれぞれ示し、314は Q_n が選択される場合の選択経路を示す。

【0010】符号量計算部218の具体的な回路ブロック図を図5に示す。230は入力データ、232は量子化パラメータ判定部、234は量子化パラメータ、236、242、246、250は量子化番号 Q_n 、238は目標符号量、240、244、248、252は計算部である。

【0011】説明上、1つの大ブロックに含まれる小ブロック数をkとすると、入力データ230は、k個の小ブロックに対する変換係数を具備する。量子化パラメータ判定部232は、k個の小ブロックのそれぞれに対してブロックの特徴を表わすパラメータを与え、量子化パラメータ234として出力する。この量子化パラメータ234は、1つの大ブロックに対して、ある量子化器 Q_n が選択されたとき、その大ブロックに含まれるk個の小ブロック全てを同じ量子化器 Q_n で量子化しないで、相対的に少しだけ Q_n からシフトした量子化器（例えば、 Q_{n+2} 、 Q_{n+1} 、 Q_{n-1} 、 Q_{n-2} など）を各小ブロックに適用するように制御する。

【0012】計算部240、244、248、252は、前述の1回分の計算を行なう回路であり、計算部240には、入力データ230、量子化パラメータ234、量子化番号236及び目標符号量238が入力する。計算部240、244、248、252は、1つの大ブロック（k個の小ブロック）分の符号量を計算し、次段で計算すべき量子化器番号242、246、250、254を出力する。

【0013】計算部240、244、248、252の計算を何回か繰り返すことにより、この大ブロックに対

する最終の量子化器番号 Q_n が得られる。図5は $N=16$ の場合の例であり、2分探索であるので、初段の量子化器番号236は $n=8$ であり、4回の計算、即ち4つの計算部240, 244, 248, 252により、適切な量子化器を決定できる。

【0014】図6は計算部510の詳細なブロック図を示す。262は入力データ、264は量子化パラメータ、266は入力量子化番号、268は量子化部、270は量子化器選択部、272は可変長符号化部、274は符号量積算部、276は実際の符号量、278は目標符号量、280は減算器、282は符号量差分、284は符号判定部、286は符号判定結果、294は量子化番号選択部、296は出力量子化番号である。

【0015】先ず、量子化器選択部270は、入力量子化番号264と量子化パラメータ266に従い、1つの量子化器又は量子化テーブルを選択し、量子化部268が、選択された量子化器又は量子化テーブルで入力データ262を量子化する。入力データ262は1つの大ブロック分、即ち k 個の小ブロックの変換係数であり、量子化パラメータ266は小ブロック単位で変更されるので、量子化器選択部270は、それに応じて、選択する量子化器又は量子化テーブルをシフトする。

【0016】可変長符号化部272は、量子化されたデータを可変長符号化し、その符号長を符号量積算部274に出力する。符号量積算部274は、入力する符号長を k 個の小ブロックについて積算し、入力量子化番号264に対する大ブロックの実際の符号量を減算器280に出力する。減算器280は、符号量積算部274の出力276から目標符号量278を減算し、符号量差分282を出力する。この符号量差分282は、プラスのとき、現在の量子化番号では符号量が多すぎることを示し、逆にマイナスのとき、符号量が少ないことを示している。

【0017】そこで、符号判定部284は、符号量差分282の極性（即ち、プラス又はマイナス）を判定し、量子化番号選択部294は、符号判定部284の判定結果286に応じて、入力量子化番号266を変換して出力量子化番号296とする。入力量子化番号を n とすると、符号量オーバーのときには $n + (N/2^{m-1})$ 、符号量アンダーのときには $n - (N/2^{m-1})$ を選択する。 N は量子化器数、 m は計算部の m 段目を示しており、図5に示す例では、 $N=16$ 、 $m=1\sim 4$ である。また、最終段の計算部では、出力量子化番号が小数点以下となるが、四捨五入により、符号量オーバー時には $n+1$ 、符号量アンダー時には n となる。これらは、2分探索法で周知の処理である。

【0018】

【発明が解決しようとする課題】図8及び図9を用いて、従来例の問題点を説明する。これらの図は何れも、最終的に選択された量子化器 Q_n による符号量及び1つ

だけ小さい量子化器 Q_{n-1} による符号量と、目標符号量との大小関係を示しており、図中、 a 、 b はそれぞれ Q_n 、 Q_{n-1} の符号量と目標符号量との差を示す。即ち、 Q_n で量子化した場合、目標符号量より a だけ符号量が少なく、 Q_{n-1} で量子化した場合、 b だけ符号量がオーバーすることを示している。図8のような場合、 a の値が小さく符号化効率が良い。しかし、図9のような場合には、 a がかなり大きくなり、符号化効率が悪く、できれば量子化器 Q_{n-1} を選択したいところだが、わずかに b だけの符号量オーバーが生じるのでやむを得ず量子化器 Q_n を選択している。

【0019】本発明は、このような問題点を解決する符号量制御装置を提示することを目的とする。

【0020】

【課題を解決するための手段】本発明に係る符号量制御装置は、複数の小ブロックからなる大ブロック単位に符号量を一定にする符号量制御装置であって、符号化量を計算する複数段の符号量計算手段と、各段における目標符号量に対する不足／超過符号量を後段に伝達する伝達手段と、当該符号量計算手段の計算結果により、伝達された不足符号量及び超過符号量の何れか一方を更新する更新手段とを具備し、当該符号量計算手段の最終段で得られる当該不足／超過符号量に従い、上記各小ブロック符号化する際の量子化パラメータを操作し、もって発生符号量を当該目標符号量に近付けることを特徴とする。

【0021】

【作用】上記手段により、従来例と同様に決定した量子化手段を用いた場合の超過符号量の他に、これより1段だけ量子化幅の小さい量子化手段を用いた場合の超過符号量を得るようにした。そして、得られた不足符号量と超過符号量から、各小ブロック毎の量子化パラメータを制御して、全体として目標符号量に近付ける。

【0022】

【実施例】以下、図面を参照して本発明の実施例を詳細に説明する。

【0023】図1は、本発明の一実施例である符号量制御装置の概略構成ブロック図を示す。10は入力データ、12は量子化パラメータ判定部、14は量子化パラメータ、16, 26, 34, 42, 52は量子化番号 Q_n 、18は初期不足データ量、20は初期超過データ量、22は目標符号量、24, 32, 40, 48は計算部、28, 36, 44, 54は不足データ量、30, 38, 46, 56は超過データ量、50は操作前の量子化パラメータ、58は量子化パラメータ操作部、60は操作後の量子化パラメータである。

【0024】計算部24, 32, 40, 48における動作の大部分は、図5に示した従来例と全く同じなので、説明を省略し、本実施例との特徴的動作を詳細に説明する。

【0025】各計算部24, 32, 40, 48には2つ

の入力と2つの出力が追加されており、2段目の計算部32を例にとると、先ず、入力量子化番号26による符号量計算が行われ、その結果によって前段から入力される不足データ量28又は超過データ量30のいずれかが更新されて、それぞれ不足データ量36又は超過データ量38として次段に出力される。ここで、不足/超過データ量とは、現在の量子化番号による符号量と目標符号量との差分を表わす。

【0026】以上の動作を4段繰り返し、最終的な不足/超過データ量54、56が得られる。正確には、最終的に決定された量子化番号52を Q_n とすると、符号54は、 Q_n で符号化した場合に目標符号量に不足するデータ量を示し、符号56は Q_{n-1} で符号化した場合に目標符号量から超過するデータ量を示す。それぞれ、図8及び図9のa、bに相当する。

【0027】量子化パラメータ操作部58は、この不足/超過データ量を用いて、量子化パラメータ50（量子化パラメータ14と同じ内容だが、遅延している。）を操作し、新たな量子化パラメータ60を出力する。量子化パラメータ60は、従来例でも述べたように、大ブロック単位に選択された Q_n に対して、小ブロック単位にその Q_n から相対的にシフトした量子化器を用いるように指示するパラメータであり、k個のうちのいくつかを操作することで符号量の微調整が可能になる。

【0028】次に、計算部24、32、40、48の詳細な回路構成を図2に示す。図2において、62は入力データ、64は量子化パラメータ、66は入力量子化番号、68は量子化部、70は量子化器選択部、72は可変長符号化部、74は符号量積算部、76は実際の符号量、78は目標符号量、80は減算器、82は符号量差分、84は符号判定部、86は符号判定結果、88は不足データ量入力、90は超過データ量入力、92は切換えスイッチ、94は量子化番号選択部、96は出力量子化番号、98は不足データ量出力、100は超過データ量出力である。

【0029】図2で、従来例の図6と同じ部分は同じに動作するので、図2で追加した部分を詳細に説明する。

【0030】符号量積算部74は、図6で説明したように、入力量子化番号66に対する実際の符号量を出力線76上に出力する。減算器80は実際の符号量76から目標符号量78を減算し、符号量差分82を出力する。符号判定結果86は、符号量差分82の符号、即ち極性を示す。

【0031】スイッチ92は符号判定結果86により、入力した不足データ量88及び超過データ量90のいずれか一方を符号量差分82で更新して、出力線98、100に出力する。更新されないデータ量は、そのまま出力される。例えば、符号量がオーバーした場合、図にあるように不足データ量88はそのまま出力され、超過データ量90はこの計算部でオーバーしたデータ量82の

値で置換されて出力される。

【0032】この構成により、図1において4段の計算部を経由すると、信号線54、56上に目的の不足/超過データ量が得られる。これを図7を用いて説明する。図7において、314は量子化器 Q_n が選択される過程を示している。矢印を逆にたどると、 Q_n と Q_{n-1} の符号量計算が4段目及び3段目でなされており、目的のデータ量が得られることがわかる。

【0033】もう一つの Q_n の場合を考えると、4段目で Q_n の不足データ量が得られ、1段目は Q_n の超過データ量が得られる。特に、1段目の超過データ量は、2～4段目で符号量がオーバーしないので途中で書き換えられずに最後まで伝送される。他の Q_n も同様にして不足/超過データのいずれか一方が1回も計算されないの

で、正しい結果が得られない。
【0034】図1の量子化パラメータ操作部58の詳細な回路ブロック図を図3に示す。110は量子化パラメータ入力、112は選択された量子化番号 Q_n 、114は不足データ量、116は超過データ量、118は除算器、122は乗算器、126は加算器、130は比較器、132は切換えスイッチ、134は量子化パラメータ出力である。

【0035】先ず、入力された不足/超過データ量110、112を図8及び図9に対応してそれぞれa、b（ $a \geq 0$ 、 $b \geq 0$ ）とすると、除算器118は $a/(a+b)$ を計算し、量子化番号を1つ小さくした場合に増加する符号量に対する現在の不足データ量の割合120を出力する。1つ量子化番号を小さくすることは、量子化番号を変えないで、k個の量子化パラメータ全部を操作して、各小ブロックの量子化番号を1だけ小さい方にシフトするのと等価であるから、この割合120を乗算器122でk倍することで、k個のパラメータの内、何個を操作すれば良いかがわかる。

【0036】加算器126は、量子化パラメータを操作する。具体的には、ここでは、パラメータを1だけ増加すれば、1つ小さい量子化器にシフトされると仮定している。入力されたk個の量子化パラメータ110のうち、乗算器122の出力124で指定される個数のパラメータが、加算器126で1だけパラメータ値を増加され、新たなパラメータとして出力128に出力される。

【0037】比較器130は量子化番号112が1又は16でないか否かを判定し、1又は16のときには前述の問題があるのでスイッチ132により操作前のパラメータ110を出力するようにする。なお、ここでは乗算器122の出力124で指定されるパラメータ数を割合120としたが、実際には符号量オーバーの可能性があるので、多少少なめにするのがよい。

【0038】また、加算器126で量子化パラメータ値を増加する際、どの小ブロックから行なうかについては、例えばY信号と色差信号のブロックがある場合はY

信号のブロックから順に、あるいは既に量子化パラメータ値が大きいものは後回しにして、パラメータ値の小さいものから順に、といった方法が考えられる。

【0039】本発明の一実施例を説明したが、ここで、本発明の基本的な考え方を改めて説明する。各小ブロックの量子化パラメータ k 個全てを1つ小さい量子化器を選ぶように操作することは、量子化パラメータを全く操作しないで大ブロック全体の量子化番号 Q_n の代わりに Q_{n-1} を用いることと同等であり、従って、 $0 \sim k$ 個の量子化パラメータを操作すれば、等価的に量子化器 Q_n 10 $\sim Q_{n-1}$ が得られることになる。

【0040】

【発明の効果】以上の説明により容易に理解できるように、本発明によれば、目標符号量を満たす量子化器 Q_n が選択されたとき、 Q_n による不足符号量と Q_{n-1} による超過符号量を用いることで、更に目標符号量近付けることができ、符号化効率が改善される。

【図面の簡単な説明】

【図1】 本発明の一実施例である符号量制御装置の概略構成ブロック図である。

【図2】 計算部24, 32, 40, 48の詳細な回路構成ブロック図である。

【図3】 量子化パラメータ操作部58の詳細な回路ブロック図である。

【図4】 従来の高能率符号化装置の概略構成ブロック図である。

【図5】 符号量計算部218の概略回路ブロック図である。

【図6】 計算部240, 244, 248, 252の詳細なブロック図である。

【図7】 量子化器の選択過程の一例である。

【図8】 量子化器 Q_n , Q_{n-1} の符号量と目標符号量の関係の説明図である。

【図9】 量子化器 Q_n , Q_{n-1} の符号量と目標符号量の関係の説明図である。

【符号の説明】

10:入力データ

12:量子化パラメータ判定部

14:量子化パラメータ

16, 26, 34, 42, 52:量子化番号 Q_n

18:初期不足データ量

20:初期超過データ量

22:目標符号量

24, 32, 40, 48:計算部

28, 36, 44, 54:不足データ量

30, 38, 46, 56:超過データ量

50:操作前の量子化パラメータ

58:量子化パラメータ操作部

60:操作後の量子化パラメータ

62:入力データ

64:量子化パラメータ

66:入力量子化番号

68:量子化部

70:量子化器選択部

72:可変長符号化部

74:符号量積算部

76:実際の符号量

78:目標符号量

80:減算器

82:符号量差分

84:符号判定部

86:符号判定結果

88:不足データ量入力

90:超過データ量入力

92:切換えスイッチ

94:量子化番号選択部

96:出力量子化番号

98:不足データ量出力

100:超過データ量出力

110:量子化パラメータ入力

112:選択された量子化番号 Q_n

114:不足データ量

116:超過データ量

118:除算器

122:乗算器

126:加算器

130:比較器

132:切換えスイッチ

134:量子化パラメータ出力

210:大ブロック化部

212:小ブロック化部

214:直交交換部

216:量子化器

218:符号量計算部

220:量子化器選択部

222:可変長符号化部

230:入力データ

232:量子化パラメータ判定部

234:量子化パラメータ

236, 242, 246, 250, 254:量子化番号 Q_n

238:目標符号量

240, 244, 248, 252:計算部

262:入力データ

264:量子化パラメータ

266:入力量子化番号

268:量子化部

270:量子化器選択部

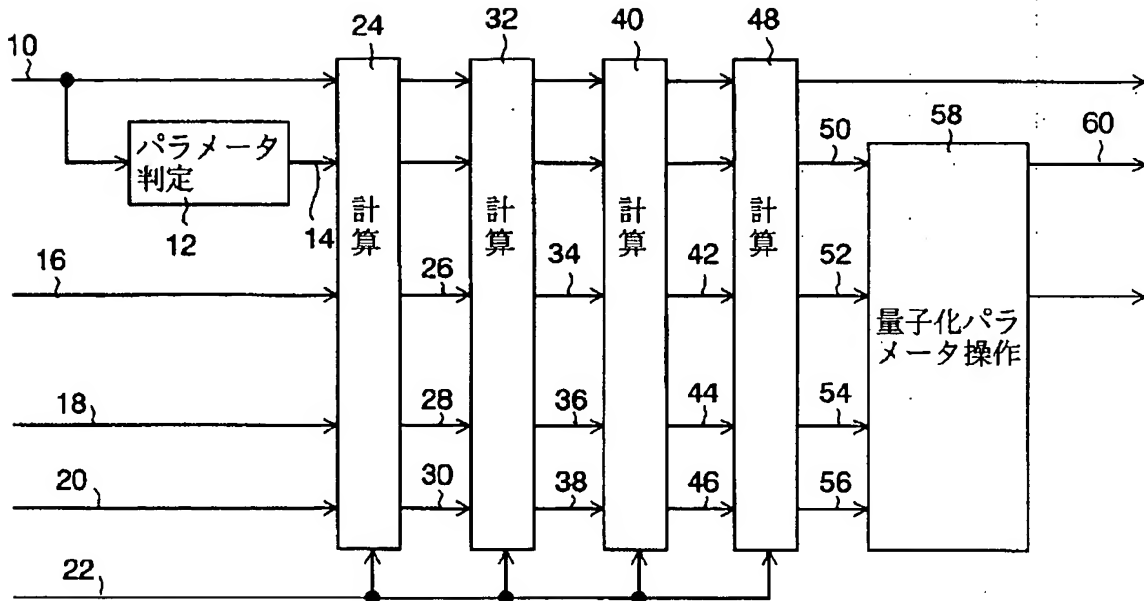
272:可変長符号化部

274:符号量積算部

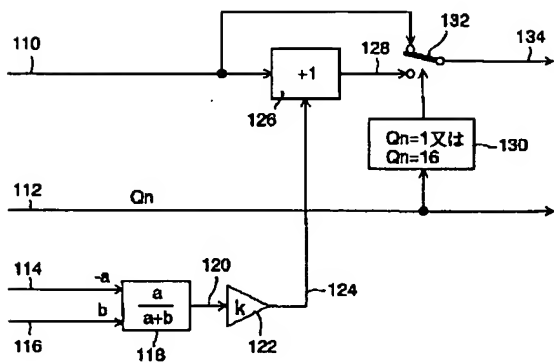
276: 実際の符号量
 278: 目標符号量
 280: 減算器
 282: 符号量差分
 284: 符号判定部
 286: 符号判定結果

* 294: 量子化番号選択部
 296: 出力量子化番号
 310: 符号量が目標符号量よりも小さい場合の選択方向
 312: 符号量が目標符号量より大きい場合の選択方向
 * 314: Q_n が選択される場合の選択経路

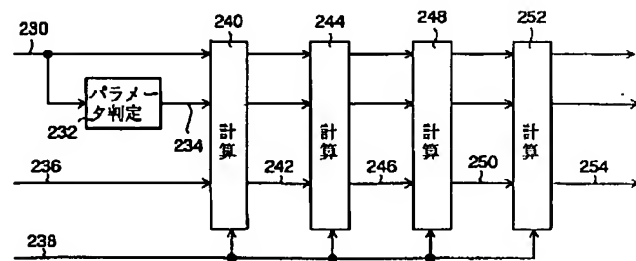
【図1】



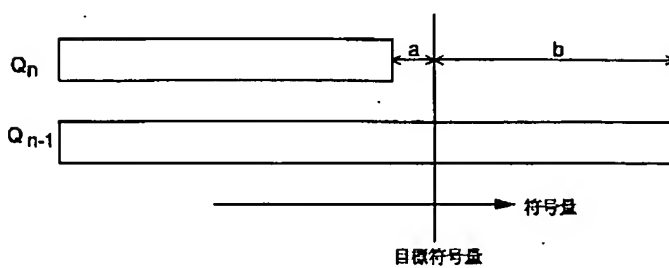
【図3】



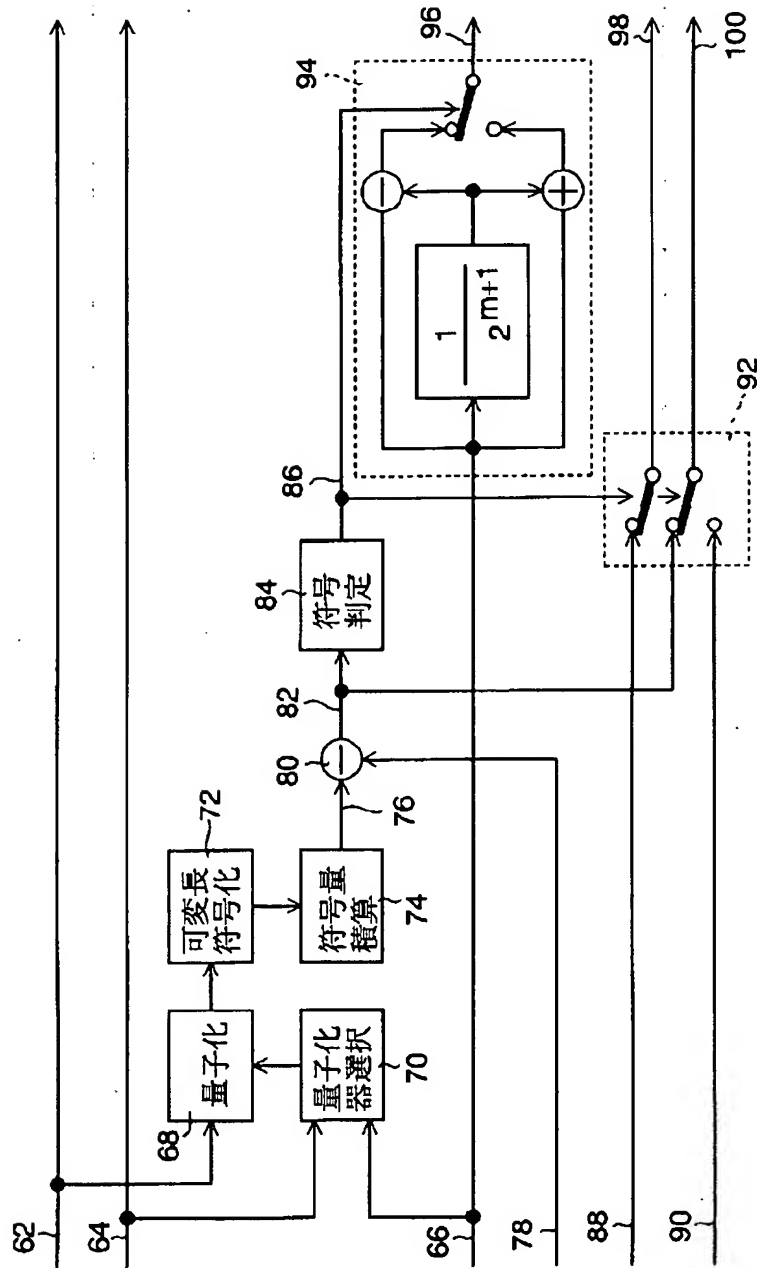
【図5】



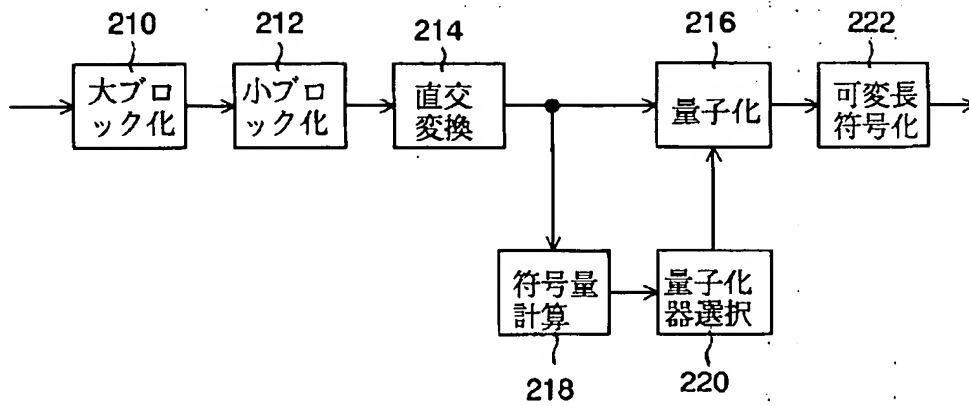
【図8】



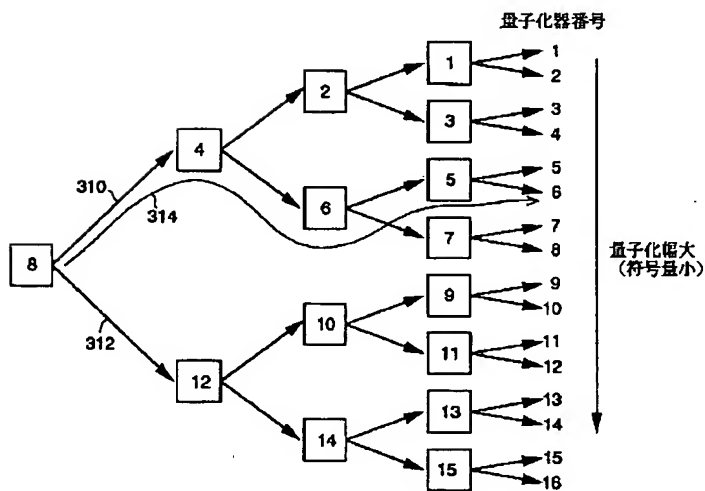
【図2】



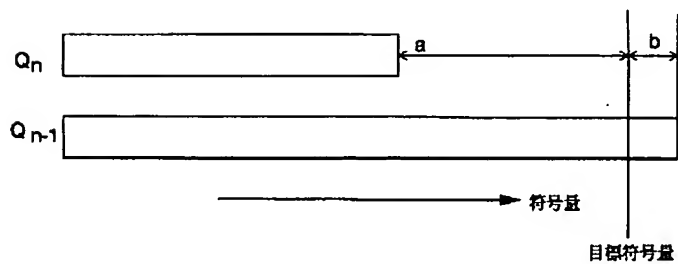
【図4】



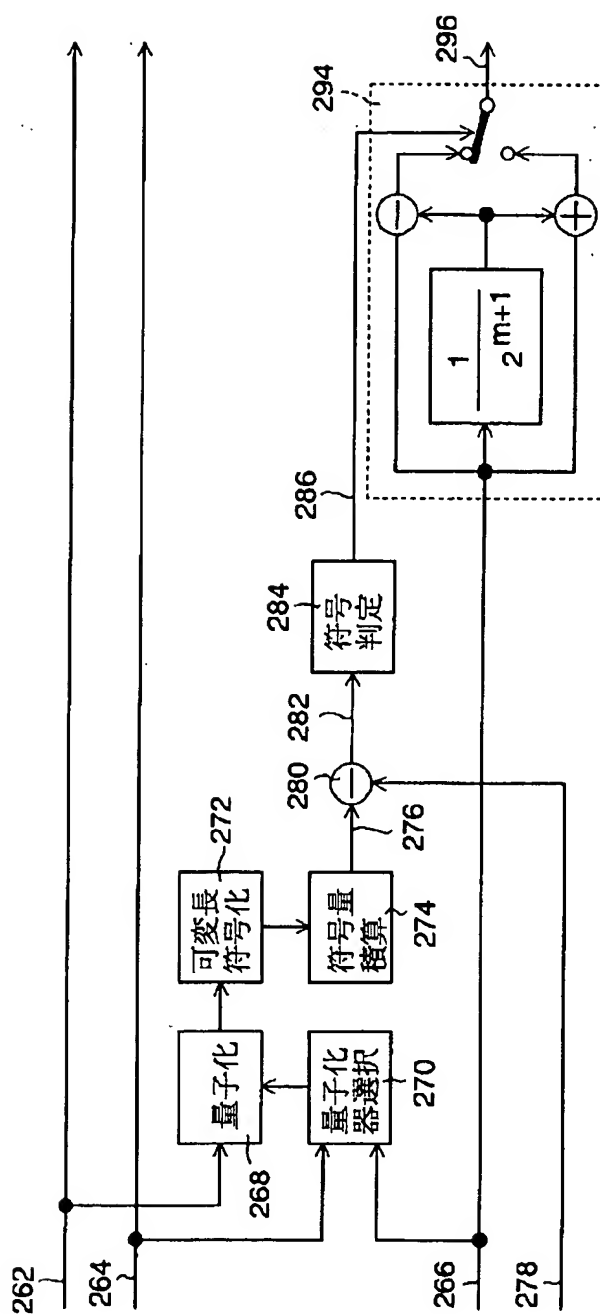
【図7】



【図9】



【図6】



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(57) **Abstract**(Modified)

Objects of the InventionWhen quantizer Q_n which fills target code quantity is chosen, it brings close to target code quantity, and encoding efficiency is improved.

Elements of the InventionWhen determining a quantizer which becomes below target code quantity from two or more quantizers by dichotomizing search, the insufficient data volume and the amount of excess data in case a code amount is based on a quantizer of one next door which increase in number more than target code quantity are computed, and final shortage / amounts 54/56 of excess data are obtained. When this makes Q_n the quantization number 52 determined eventually, 54 shows insufficient data volume to the target code quantity 22 at the time of coding by Q_n , and 56 shows the amount of excess data from target code quantity at the time of coding by Q_{n-1} . Using this insufficient data volume and the amount of excess data, by the quantization parameter final controlling element 58. The quantization parameter 50 is operated, the new quantization parameter 60 is obtained, and a quantizer which is relatively shifted to each small block unit from Q_n , and is applied to it is determined to Q_n chosen as a large block unit.

Claim(s)

Claim 1Two or more steps of code amount calculating means which calculate encoding quantity by being a code quantity controller which makes a code amount at regularity a large block unit which consists of two or more small blocks, The shortage / excess code amount to target code quantity in each stage by a calculation result of a means of communication transmitted to the latter part, and

the code amount calculating means concerned. An update means which updates either one of a transmitted insufficient code amount and an excess code amount is provided, A code quantity controller operating and having a quantization parameter at each above-mentioned time of carrying out small block coding according to the shortage / the excess code amount concerned obtained in a final stage of the code amount calculating means concerned, and bringing a generated code amount close to the target code quantity concerned.

Detailed Description of the Invention

0001

Industrial Application This invention more specifically relates to the code quantity controller in the coding equipment using a variable length code about the code quantity controller in coding equipment.

0002

Description of the Prior Art The outline configuration block figure of conventional highly efficient coding equipment is shown in drawing 4. in drawing 4 -- 210 -- as for quantizer 218, a small block-sized part and 214 are **a quantizer selecting part and 222** variable length coding sections a code quantity calculation section and 220 an orthogonal transformation section and 216 a large blocking part and 212.

0003 First, image data is inputted into the large blocking part 210, and is divided into some large blocks here. This large block collects some small blocks mentioned later, and coding is controlled so that a code amount becomes fixed by a large block unit. Therefore, the small blocks beforehand shuffled on the screen are collected, and it is considered as a large block in many cases so that the amount of information of an original image may be equalized.

0004 The small block-sized part 212 divides each large block into some small blocks. This small block serves as a unit of the orthogonal transformation mentioned later, and 8 pixels long and 8 pixels wide are often used.

0005 The orthogonal transformation section 214 carries out orthogonal transformation of each small block, and outputs the result (it is called a conversion factor.). Orthogonal transformation is a discrete cosine transform (DCT).

0006 Although quantized by the quantizing part 216, a conversion factor, Before that, the code quantity calculation section 218 calculates the final code amount in a large block unit, and the quantizer selecting part 220 chooses the quantizer (or quantization table) which can attain a predetermined code amount, namely, does not exceed target code quantity according to the result. The details of the code quantity calculation section 218 are mentioned later.

0007 Variable length coding of the conversion factor quantized by the quantizing part 216 is carried out by the variable length coding section 222. After carrying out the zigzag scan of the conversion factor in each small block and carrying out run length coding from the low-pass side, specifically, Huffman encoding is carried out. On these Descriptions, it will be called variable length coding including these the processings of a series of.

0008 Operation of the code quantity calculation section 218 is explained. When there are N quantizers, the number of 1 to N is beforehand given sequentially from a quantizer with small quantization width, and each quantizer will be specified by Q_n ($n=1-N$). If it sees from a code amount, a code amount will increase, so that n is small. As mentioned above, in order to hold down to a target code amount by a large block unit, it is SUBJECT here to choose one Q_n for every large block.

0009 Although a suitable quantizer is determined, binary search is used, for example. Namely, a code amount is calculated by choosing central quantizer $Q_{N/2}$, and specifically performing quantization and variable length coding actually. Since the target quantizer is between $Q_{\text{from } Q_1}^{N/2}$

when the code amount is smaller than target code quantity, the same calculation is repeated by middle its quantizer $Q_{N/4}$. Conversely, when a code amount is larger than target code quantity, the same calculation is repeated by quantizer $Q_{3N/4}$. Thus, when there are N quantizers, the target quantizer can be determined by $\log_2 N$ time. The selection process of the quantizer in $N=16$ is

shown in drawing 7. Drawing 7 shows a selected direction when a code amount of 310 is smaller than target code quantity, and a selected direction when a code amount of 312 is larger than target code quantity, respectively, and 314 shows a selection course in case Q_6 is chosen.

0010The concrete circuit block figure of the code quantity calculation section 218 is shown in drawing 5. As for a quantization parameter and 236, 242, 246, 250, input data and 232 are **target code quantity and 240, 244, 248, 252** calculation parts quantization number Q_n and 238 a quantization parameter judgment part and 234 230.

0011On explanation, if the number of small blocks contained in one large block is set to k , the input data 230 possesses the conversion factor to k small blocks. The quantization parameter judgment part 232 gives the parameter with which the feature of a block is expressed to each of k small blocks, and outputs it as the quantization parameter 234. This quantization parameter 234 without quantizing all k small blocks contained in that large block with the same quantizer Q_n , when certain quantizer Q_n is chosen to one large block, It controls to apply the quantizers (for example, Q_{n+2} , Q_{n+1} , Q_{n-1} , Q_{n-2} , etc.) which shifted only a few from Q_n relatively to each small block.

0012The calculation part 240, 244, 248, 252 is a circuit which calculates the above-mentioned draft. The input data 230, the quantization parameter 234, the quantization number 236, and the target code quantity 238 input into the calculation part 240.

The calculation part 240, 244, 248, 252 outputs the quantizer number 242, 246, 250, 254 which should calculate the code amount for one large block (k small blocks), and should be calculated by the next step.

0013By repeating calculation of the calculation part 240, 244, 248, 252 several times, the last quantizer number Q_n to this large block is obtained. Since drawing 5 is an example in $N = 16$ and it is dichotomizing search, the quantizer number 236 of the first rank is $n = 8$, and can determine a suitable quantizer by four calculations 240, 244, 248, 252, i.e., four calculation parts.

0014Drawing 6 shows the detailed block diagram of the calculation part 510. 262 input data and 264 a quantization parameter and 266 An input quantity child-sized number, 268 a quantizing part and 270 a quantizer selecting part and 272 A variable length coding section, a code amount integrating part, the code amount in which 274 is actual as for 276, and 278 -- as for a code judging part and 286, a subtractor and 282 are **a quantization number selecting part and 296** output quantity child-sized numbers a code judging result and 294 code amount difference and 284 target code quantity and 280.

0015First, the quantizer selecting part 270 chooses one quantizer or a quantization table according to the input quantity child-sized number 264 and the quantization parameter 266, and the quantizing part 268 quantizes the input data 262 on the selected quantizer or quantization table. The input data 262 is a conversion factor for one large block (i.e., k small blocks), and since the quantization parameter 266 is changed per small block, the quantizer selecting part 270 shifts the quantizer or quantization table to choose according to it.

0016The variable length coding section 272 carries out variable length coding of the quantized data, and outputs the code length to the code amount integrating part 274. The code amount integrating part 274 integrates the code length who inputs about k small blocks, and outputs the actual code amount of the large block over the input quantity child-sized number 264 to the subtractor 280. The subtractor 280 subtracts the target code quantity 278 from the output 276 of the code amount integrating part 274, and outputs the code amount difference 282. At the time of plus, this code amount difference 282 shows that there are too many code amounts by the present quantization number, and shows conversely that there are few code amounts by it at the time of minus.

0017Then, the code judging part 284 judges the polarity (namely, plus or minus) of the code amount difference 282, and according to the decision result 286 of the code judging part 284, the quantization number selecting part 294 changes the input quantity child-sized number 266, and makes it the output quantity child-sized number 296. If an input quantity child-sized number is set to n , at the time of code amount over, $n - (N/2^{m+1})$ will be chosen at the time of $n + (N/2^{m+1})$ and a code amount undershirt. In the example which N shows the number of quantizers, and m shows eye m stage of the calculation part, and is shown in drawing 5, it is $N = 16$ and $m = 1-4$. In the

calculation part of a final stage, although an output quantity child-sized number becomes below in a decimal point, at the time of code amount over, it is set to n by rounding off at the time of $n+1$ and a code amount undershirt. These are processings of well-known by binary search.

0018

Problem(s) to be Solved by the InventionThe problem of a conventional example is explained using drawing 8 and drawing 9. Each of these figures shows only the code amount by eventually selected quantizer Q_n , and one size relation of the code amount by small quantizer Q_{n-1} , and target code quantity, and a and b show the difference of the code amount of Q_n and Q_{n-1} , and target code quantity among a figure, respectively. That is, when it quantizes by Q_n , only a has few code amounts than target code quantity, and when it quantizes by Q_{n-1} , it is shown that a code amount exceeds only b . Case **like drawing 8**, the value of a is small and encoding efficiency is good. However, case **like drawing 9**, a became quite large, encoding efficiency is bad, and if it can do, since the code amount over of only b arises, the quantizer Q_n will have been chosen unavoidably but the place to choose quantizer Q_{n-1} as.

0019An object of this invention is to show the code quantity controller which solves such a problem.

0020

Means for Solving the ProblemTwo or more steps of code amount calculating means which calculate encoding quantity by a code quantity controller concerning this invention being a code quantity controller which makes a code amount at regularity a large block unit which consists of two or more small blocks, The shortage / excess code amount to target code quantity in each stage by a calculation result of a means of communication transmitted to the latter part, and the code amount calculating means concerned. An update means which updates either one of a transmitted insufficient code amount and an excess code amount is provided, According to the shortage / the excess code amount concerned obtained in a final stage of the code amount calculating means concerned, it operates and has a quantization parameter at each above-mentioned time of carrying out small block coding, and a generated code amount is brought close to the target code quantity concerned.

0021

FunctionThe excess code amount at the time of using one step of quantization means with small quantization width from this other than the excess code amount at the time of using the quantization means similarly determined as the conventional example by the above-mentioned means was obtained. And from the obtained insufficient code amount and an excess code amount, the quantization parameter for every small block is controlled, and it brings close to target code quantity as a whole.

0022

ExampleHereafter, with reference to Drawings, working example of this invention is described in detail.

0023Drawing 1 shows the outline configuration block figure of the code quantity controller which is one working example of this invention. 10 input data and 12 a quantization parameter judgment part and 14 A quantization parameter, Quantization number Q_n and 18 16, 26, 34, 42, and 52 Initial insufficient data volume, 20 the amount of initial excess data, and 22 target code quantity, and 24, 32, 40 and 48 A calculation part, As for the amount of excess data, and 50, 28, 36, 44, and 54 are **a quantization parameter final controlling element and 60** the quantization parameters after operation insufficient data volume, and 30, 38, 46 and 56 the quantization parameter before operation, and 58.

0024Since the great portion of operation in the calculation parts 24, 32, 40, and 48 is completely the same as the conventional example shown in drawing 5, it omits explanation and explains characteristic operation with this example in detail.

0025If two inputs and two outputs are added to each calculation parts 24, 32, 40, and 48 and the 2nd step of calculation part 32 is taken for an example, First, code amount calculation by the input quantity child-sized number 26 is performed, either **which is inputted from the preceding paragraph by the result** the insufficient data volume 28 or the amount 30 of excess data is updated, and it is outputted to the next step as the insufficient data volume 36 or the amount 38

of excess data, respectively. Here, the difference of the code amount and target code quantity by the present quantization number is expressed as shortage/the amount of excess data.

0026The above four steps of operations are repeated and final shortage / amounts 54 and 56 of excess data are obtained. When the quantization number 52 determined eventually correctly is made into Q_n , the numerals 54 show the data volume which target code quantity runs short of, when it codes by Q_n , and the numerals 56 show the data volume exceeded from target code quantity, when it codes by Q_{n-1} . Respectively, it is equivalent to a of drawing 8 and drawing 9, and b.

0027Using this shortage/amount of excess data, the quantization parameter final controlling element 58 operates the quantization parameter 50 (delayed although it is the same contents as the quantization parameter 14.), and outputs the new quantization parameter 60. The quantization parameter 60 is a parameter it is directed that uses the quantizer relatively shifted from the Q_n per small block to Q_n chosen as the large block unit, as the conventional example also described.

Fine adjustment of a code amount is attained by operating some of the k pieces.

0028Next, the detailed circuitry of the calculation parts 24, 32, 40, and 48 is shown in drawing 2. In drawing 2, 62 input data and 64 a quantization parameter and 66 An input quantity child-sized number, A quantizing part and 70 for 68 a quantizer selecting part and 72 a variable length coding section and 74 A code amount integrating part, A code amount with actual 76 and 78 target code quantity and 80 a subtractor and 82 Code amount difference, 84 -- a code judging part and 86 -- a code judging result and 88 -- as for a quantization number selecting part and 96, the amount input of excess data and 92 are **an insufficient data volume output and 100** the amount outputs of excess data an output quantity child-sized number and 98 a changeover switch and 94 an insufficient data volume input and 90.

0029Since the portion same at drawing 2 as drawing 6 of a conventional example similarly operates, the portion added by drawing 2 is explained in detail.

0030The code amount integrating part 74 outputs the actual code amount to the input quantity child-sized number 66 on the output line 76, as drawing 6 explained. The subtractor 80 subtracts the target code quantity 78 from the actual code amount 76, and outputs the code amount difference 82. The code judging result 86 shows the numerals of the code amount difference 82, i.e., polarity.

0031By the code judging result 86, the switch 92 updates either one of **which was inputted** the insufficient data volume 88 and the amount 90 of excess data by the code amount difference 82, and outputs it to the output line 98,100. The data volume which is not updated is outputted as it is. For example, when a code amount exceeds, as shown in a figure, the insufficient data volume 88 is outputted as it is, and the amount 90 of excess data is replaced and outputted with the value of the data volume 82 exceeded by this calculation part.

0032If it goes via four steps of calculation parts in drawing 1 by this composition, target shortage/amount of excess data will be obtained on the signal wire 54 and 56. This is explained using drawing 7. In drawing 7, 314 shows the process in which quantizer Q_6 is chosen. When an arrow is followed conversely, it turns out that code amount calculation of Q_6 and Q_5 is made in the 4th step and the 3rd step, and the target data volume is obtained.

0033Considering the case of another Q_9 , the insufficient data volume of Q_9 is obtained in the 4th step, and, as for the 1st step, the amount of excess data of Q_8 is obtained. Since a code amount does not exceed in the 2-4th step, the 1st step of especially amount of excess data is transmitted to the last, without being rewritten on the way. As for other Q_n , since either one of shortage/excess data are not calculated once similarly, a right result is not obtained.

0034The detailed circuit block figure of the quantization parameter final controlling element 58 of drawing 1 is shown in drawing 3. a quantization parameter input, quantization number Q_n for which 110 was chosen 112, and 114 -- insufficient data volume and 116 -- as for an adding machine and 130, a divider and 122 are **a changeover switch and 134** quantization parameter outputs a comparator and 132 a multiplier and 126 the amount of excess data, and 118.

0035first, the present insufficient data volume to the code amount which increases when the

inputted shortage / the amount 110, 112 of excess data were set to a and b ($a \geq 0$, $b \geq 0$) corresponding to drawing 8 and drawing 9, respectively, the divider 118 calculates $a/(a+b)$ and a quantization number is made small one -- 120 is outputted comparatively. Making 1 quantization number small operates all k quantization parameters without changing a quantization number, Since it is equivalent to only 1 shifting the quantization number of each small block to the smaller one, it understands whether it should operate how many of k parameters by increasing this rate 120 k times with the multiplier 122.

0036The adding machine 126 operates a quantization parameter. If only 1 increases a parameter, specifically, it will be assumed here that it is shifted to a quantizer small **one**. Only 1 has parameter value increased with the adding machine 126, and the parameter of the number specified with the output 124 of the multiplier 122 among the k inputted quantization parameters 110 is outputted to the output 128 as a new parameter.

0037The comparator 130 judges whether the quantization number 112 is 1 or 16, and since there is the above-mentioned problem at the time of 1 or 16, it is made to output the parameter 110 before operation with the switch 132. Although the number of parameters specified with the output 124 of the multiplier 122 here was comparatively set to 120, since there is possibility of code amount over actually, it is good to lessen some slightly.

0038When increasing a quantization parameter value with the adding machine 126, about from which small block it carries out. for example, the order from the thing which has small parameter value and which makes deferment order or what has an already large quantization parameter value from the block of a Y signal when there is a block of a Y signal and a color-difference signal -- the said method can be considered.

0039Although one working example of this invention was described, the fundamental view of this invention is explained anew here. Operating all k quantization parameters of each small block so that a quantizer small **one** may be chosen, If it is equivalent to using Q_{n-1} instead of quantization number Q_n of the whole large block without completely operating a quantization parameter, therefore 0- k quantization parameters are operated, quantizer $Q_n - Q_{n-1}$ will be obtained equivalent.

0040

Effect of the InventionWhen quantizer Q_n which fills target code quantity is chosen according to this invention so that he can understand easily by the above explanation, by using the insufficient code amount by Q_n , and the excess code amount by Q_{n-1} , ***** attachment ***** is made further and encoding efficiency is improved.

Industrial ApplicationThis invention more specifically relates to the code quantity controller in the coding equipment using a variable length code about the code quantity controller in coding equipment.

Description of the Prior ArtThe outline configuration block figure of conventional highly efficient coding equipment is shown in drawing 4. in drawing 4 -- 210 -- as for quantizer 218, a small block-ized part and 214 are **a quantizer selecting part and 222** variable length coding sections a code quantity calculation section and 220 an orthogonal transformation section and 216 a large blocking part and 212.

0003First, image data is inputted into the large blocking part 210, and is divided into some large blocks here. This large block collects some small blocks mentioned later, and coding is controlled so that a code amount becomes fixed by a large block unit. Therefore, the small blocks beforehand shuffled on the screen are collected, and it is considered as a large block in many cases so that the amount of information of an original image may be equalized.

0004The small block-ized part 212 divides each large block into some small blocks. This small block serves as a unit of the orthogonal transformation mentioned later, and 8 pixels long and 8

pixels wide are often used.

0005The orthogonal transformation section 214 carries out orthogonal transformation of each small block, and outputs the result (it is called a conversion factor.). Orthogonal transformation is a discrete cosine transform (DCT).

0006Although quantized by the quantizing part 216, a conversion factor, Before that, the code quantity calculation section 218 calculates the final code amount in a large block unit, and the quantizer selecting part 220 chooses the quantizer (or quantization table) which can attain a predetermined code amount, namely, does not exceed target code quantity according to the result. The details of the code quantity calculation section 218 are mentioned later.

0007Variable length coding of the conversion factor quantized by the quantizing part 216 is carried out by the variable length coding section 222. After carrying out the zigzag scan of the conversion factor in each small block and carrying out run length coding from the low-pass side, specifically, Huffman encoding is carried out. On these Descriptions, it will be called variable length coding including these the processings of a series of.

0008Operation of the code quantity calculation section 218 is explained. When there are N quantizers, the number of 1 to N is beforehand given sequentially from a quantizer with small quantization width, and each quantizer will be specified by Q_n ($n=1-N$). If it sees from a code amount, a code amount will increase, so that n is small. As mentioned above, in order to hold down to a target code amount by a large block unit, it is SUBJECT here to choose one Q_n for every large block.

0009Although a suitable quantizer is determined, binary search is used, for example. Namely, a code amount is calculated by choosing central quantizer $Q_{N/2}$, and specifically performing quantization and variable length coding actually. Since the target quantizer is between $Q_{1, N/2}$

when the code amount is smaller than target code quantity, the same calculation is repeated by middle its quantizer $Q_{N/4}$. Conversely, when a code amount is larger than target code quantity, the same calculation is repeated by quantizer $Q_{3N/4}$. Thus, when there are N quantizers, the target quantizer can be determined by $\log_2 N$ time. The selection process of the quantizer in $N=16$ is shown in drawing 7. Drawing 7 shows a selected direction when a code amount of 310 is smaller than target code quantity, and a selected direction when a code amount of 312 is larger than target code quantity, respectively, and 314 shows a selection course in case Q_6 is chosen.

0010The concrete circuit block figure of the code quantity calculation section 218 is shown in drawing 5. As for a quantization parameter and 236,242,246,250, input data and 232 are **target code quantity and 240,244,248,252** calculation parts quantization number Q_n and 238 a quantization parameter judgment part and 234 230.

0011On explanation, if the number of small blocks contained in one large block is set to k, the input data 230 possesses the conversion factor to k small blocks. The quantization parameter judgment part 232 gives the parameter with which the feature of a block is expressed to each of k small blocks, and outputs it as the quantization parameter 234. This quantization parameter 234 without quantizing all k small blocks contained in that large block with the same quantizer Q_n , when certain quantizer Q_n is chosen to one large block, It controls to apply the quantizers (for example, Q_{n+2} , Q_{n+1} , Q_{n-1} , Q_{n-2} , etc.) which shifted only a few from Q_n relatively to each small block.

0012The calculation part 240,244,248,252 is a circuit which calculates the above-mentioned draft. The input data 230, the quantization parameter 234, the quantization number 236, and the target code quantity 238 input into the calculation part 240.

The calculation part 240,244,248,252 outputs the quantizer number 242,246,250,254 which should calculate the code amount for one large block (k small blocks), and should be calculated by the next step.

0013By repeating calculation of the calculation part 240,244,248,252 several times, the last quantizer number Q_n to this large block is obtained. Since drawing 5 is an example in $N=16$ and it is dichotomizing search, the quantizer number 236 of the first rank is $n=8$, and can determine a suitable quantizer by four calculations 240,244,248,252, i.e., four calculation parts.

0014 Drawing 6 shows the detailed block diagram of the calculation part 510. 262 input data and 264 a quantization parameter and 266 An input quantity child-sized number, 268 a quantizing part and 270 a quantizer selecting part and 272 A variable length coding section, a code amount integrating part, the code amount in which 274 is actual as for 276, and 278 -- as for a code judging part and 286, a subtractor and 282 are a **quantization number selecting part and 296** output quantity child-sized numbers a code judging result and 294 code amount difference and 284 target code quantity and 280.

0015 First, the quantizer selecting part 270 chooses one quantizer or a quantization table according to the input quantity child-sized number 264 and the quantization parameter 266, and the quantizing part 268 quantizes the input data 262 on the selected quantizer or quantization table. The input data 262 is a conversion factor for one large block (i.e., k small blocks), and since the quantization parameter 266 is changed per small block, the quantizer selecting part 270 shifts the quantizer or quantization table to choose according to it.

0016 The variable length coding section 272 carries out variable length coding of the quantized data, and outputs the code length to the code amount integrating part 274. The code amount integrating part 274 integrates the code length who inputs about k small blocks, and outputs the actual code amount of the large block over the input quantity child-sized number 264 to the subtractor 280. The subtractor 280 subtracts the target code quantity 278 from the output 276 of the code amount integrating part 274, and outputs the code amount difference 282. At the time of plus, this code amount difference 282 shows that there are too many code amounts by the present quantization number, and shows conversely that there are few code amounts by it at the time of minus.

0017 Then, the code judging part 284 judges the polarity (namely, plus or minus) of the code amount difference 282, and according to the decision result 286 of the code judging part 284, the quantization number selecting part 294 changes the input quantity child-sized number 266, and makes it the output quantity child-sized number 296. If an input quantity child-sized number is set to n, at the time of code amount over, $n - (N/2^{m+1})$ will be chosen at the time of $n + (N/2^{m+1})$ and a code amount undershirt. In the example which N shows the number of quantizers, and m shows eye m stage of the calculation part, and is shown in drawing 5, it is $N = 16$ and $m = 1-4$. In the calculation part of a final stage, although an output quantity child-sized number becomes below in a decimal point, at the time of code amount over, it is set to n by rounding off at the time of $n+1$ and a code amount undershirt. These are processings of well-known by binary search.

Effect of the Invention When quantizer Q_n which fills target code quantity is chosen according to this invention so that he can understand easily by the above explanation, by using the insufficient code amount by Q_n , and the excess code amount by Q_{n-1} , ***** attachment ***** is made further and encoding efficiency is improved.

Function The excess code amount at the time of using one step of quantization means with small quantization width from this other than the excess code amount at the time of using the quantization means similarly determined as the conventional example by the above-mentioned means was obtained. And from the obtained insufficient code amount and an excess code amount, the quantization parameter for every small block is controlled, and it brings close to target code quantity as a whole.

Example Hereafter, with reference to Drawings, working example of this invention is described in detail.

0023 Drawing 1 shows the outline configuration block figure of the code quantity controller which is one working example of this invention. 10 input data and 12 a quantization parameter judgment

part and 14 A quantization parameter, Quantization number Q_n and 18 16, 26, 34, 42, and 52 Initial insufficient data volume, 20 the amount of initial excess data, and 22 target code quantity, and 24, 32, 40 and 48 A calculation part, As for the amount of excess data, and 50, 28, 36, 44, and 54 are **a quantization parameter final controlling element and 60** the quantization parameters after operation insufficient data volume, and 30, 38, 46 and 56 the quantization parameter before operation, and 58.

0024 Since the great portion of operation in the calculation parts 24, 32, 40, and 48 is completely the same as the conventional example shown in drawing 5, it omits explanation and explains characteristic operation with this example in detail.

0025 If two inputs and two outputs are added to each calculation parts 24, 32, 40, and 48 and the 2nd step of calculation part 32 is taken for an example, First, code amount calculation by the input quantity child-sized number 26 is performed, either **which is inputted from the preceding paragraph by the result** the insufficient data volume 28 or the amount 30 of excess data is updated, and it is outputted to the next step as the insufficient data volume 36 or the amount 38 of excess data, respectively. Here, the difference of the code amount and target code quantity by the present quantization number is expressed as shortage/the amount of excess data.

0026 The above four steps of operations are repeated and final shortage / amounts 54 and 56 of excess data are obtained. When the quantization number 52 determined eventually correctly is made into Q_n , the numerals 54 show the data volume which target code quantity runs short of, when it codes by Q_n , and the numerals 56 show the data volume exceeded from target code quantity, when it codes by Q_{n-1} . Respectively, it is equivalent to a of drawing 8 and drawing 9, and b.

0027 Using this shortage/amount of excess data, the quantization parameter final controlling element 58 operates the quantization parameter 50 (delayed although it is the same contents as the quantization parameter 14.), and outputs the new quantization parameter 60. The quantization parameter 60 is a parameter it is directed that uses the quantizer relatively shifted from the Q_n per small block to Q_n chosen as the large block unit, as the conventional example also described. Fine adjustment of a code amount is attained by operating some of the k pieces.

0028 Next, the detailed circuitry of the calculation parts 24, 32, 40, and 48 is shown in drawing 2. In drawing 2, 62 input data and 64 a quantization parameter and 66 An input quantity child-sized number, A quantizing part and 70 for 68 a quantizer selecting part and 72 a variable length coding section and 74 A code amount integrating part, A code amount with actual 76 and 78 target code quantity and 80 a subtractor and 82 Code amount difference, 84 -- a code judging part and 86 -- a code judging result and 88 -- as for a quantization number selecting part and 96, the amount input of excess data and 92 are **an insufficient data volume output and 100** the amount outputs of excess data an output quantity child-sized number and 98 a changeover switch and 94 an insufficient data volume input and 90.

0029 Since the portion same at drawing 2 as drawing 6 of a conventional example similarly operates, the portion added by drawing 2 is explained in detail.

0030 The code amount integrating part 74 outputs the actual code amount to the input quantity child-sized number 66 on the output line 76, as drawing 6 explained. The subtractor 80 subtracts the target code quantity 78 from the actual code amount 76, and outputs the code amount difference 82. The code judging result 86 shows the numerals of the code amount difference 82, i.e., polarity.

0031 By the code judging result 86, the switch 92 updates either one of **which was inputted** the insufficient data volume 88 and the amount 90 of excess data by the code amount difference 82, and outputs it to the output line 98, 100. The data volume which is not updated is outputted as it is. For example, when a code amount exceeds, as shown in a figure, the insufficient data volume 88 is outputted as it is, and the amount 90 of excess data is replaced and outputted with the value of the data volume 82 exceeded by this calculation part.

0032 If it goes via four steps of calculation parts in drawing 1 by this composition, target shortage/amount of excess data will be obtained on the signal wire 54 and 56. This is explained using drawing 7. In drawing 7, 314 shows the process in which quantizer Q_g is chosen. When an

arrow is followed conversely, it turns out that code amount calculation of Q_6 and Q_5 is made in the 4th step and the 3rd step, and the target data volume is obtained.

0033 Considering the case of another Q_9 , the insufficient data volume of Q_9 is obtained in the 4th step, and, as for the 1st step, the amount of excess data of Q_8 is obtained. Since a code amount does not exceed in the 2-4th step, the 1st step of especially amount of excess data is transmitted to the last, without being rewritten on the way. As for other Q_n , since either one of shortage/excess data are not calculated once similarly, a right result is not obtained.

0034 The detailed circuit block figure of the quantization parameter final controlling element 58 of drawing 1 is shown in drawing 3. a quantization parameter input, quantization number Q_n for which 110 was chosen 112, and 114 -- insufficient data volume and 116 -- as for an adding machine and 130, a divider and 122 are a **changeover switch and 134** quantization parameter outputs a comparator and 132 a multiplier and 126 the amount of excess data, and 118.

0035 first, the present insufficient data volume to the code amount which increases when the inputted shortage / the amount 110, 112 of excess data were set to a and b ($a \geq 0$, $b \geq 0$) corresponding to drawing 8 and drawing 9, respectively, the divider 118 calculates $a/(a+b)$ and a quantization number is made small one -- 120 is outputted comparatively. Making 1 quantization number small operates all k quantization parameters without changing a quantization number, Since it is equivalent to only 1 shifting the quantization number of each small block to the smaller one, it understands whether it should operate how many of k parameters by increasing this rate 120 k times with the multiplier 122.

0036 The adding machine 126 operates a quantization parameter. If only 1 increases a parameter, specifically, it will be assumed here that it is shifted to a quantizer small **one**. Only 1 has parameter value increased with the adding machine 126, and the parameter of the number specified with the output 124 of the multiplier 122 among the k inputted quantization parameters 110 is outputted to the output 128 as a new parameter.

0037 The comparator 130 judges whether the quantization number 112 is 1 or 16, and since there is the above-mentioned problem at the time of 1 or 16, it is made to output the parameter 110 before operation with the switch 132. Although the number of parameters specified with the output 124 of the multiplier 122 here was comparatively set to 120, since there is possibility of code amount over actually, it is good to lessen some slightly.

0038 When increasing a quantization parameter value with the adding machine 126, about from which small block it carries out. for example, the order from the thing which has small parameter value and which makes deferment order or what has an already large quantization parameter value from the block of a Y signal when there is a block of a Y signal and a color-difference signal -- the said method can be considered.

0039 Although one working example of this invention was described, the fundamental view of this invention is explained anew here. Operating all k quantization parameters of each small block so that a quantizer small **one** may be chosen, If it is equivalent to using Q_{n-1} instead of quantization number Q_n of the whole large block without completely operating a quantization parameter, therefore 0-k quantization parameters are operated, quantizer $Q_n - Q_{n-1}$ will be obtained equivalent.

Problem(s) to be Solved by the Invention The problem of a conventional example is explained using drawing 8 and drawing 9. Each of these figures shows only the code amount by eventually selected quantizer Q_n , and one size relation of the code amount by small quantizer Q_{n-1} , and target code quantity, and a and b show the difference of the code amount of Q_n and Q_{n-1} , and target code quantity among a figure, respectively. That is, when it quantizes by Q_n , only a has few code amounts than target code quantity, and when it quantizes by Q_{n-1} , it is shown that a code amount exceeds only b. Case **like drawing 8**, the value of a is small and encoding efficiency is good. However, case **like drawing 9**, a became quite large, encoding efficiency is bad, and if it can do, since the code amount over of only b arises, the quantizer Q_n will have been chosen

unavoidably but the place to choose quantizer Q_{n-1} as.

0019An object of this invention is to show the code quantity controller which solves such a problem.

Means for Solving the ProblemTwo or more steps of code amount calculating means which calculate encoding quantity by a code quantity controller concerning this invention being a code quantity controller which makes a code amount at regularity a large block unit which consists of two or more small blocks, The shortage / excess code amount to target code quantity in each stage by a calculation result of a means of communication transmitted to the latter part, and the code amount calculating means concerned. An update means which updates either one of a transmitted insufficient code amount and an excess code amount is provided, According to the shortage / the excess code amount concerned obtained in a final stage of the code amount calculating means concerned, it operates and has a quantization parameter at each above-mentioned time of carrying out small block coding, and a generated code amount is brought close to the target code quantity concerned.

Brief Description of the Drawings

Drawing 1It is an outline configuration block figure of the code quantity controller which is one working example of this invention.

Drawing 2It is a detailed circuitry block diagram of the calculation parts 24, 32, 40, and 48.

Drawing 3It is a detailed circuit block figure of the quantization parameter final controlling element 58.

Drawing 4It is an outline configuration block figure of conventional highly efficient coding equipment.

Drawing 5It is an outline circuit block figure of the code quantity calculation section 218.

Drawing 6It is a detailed block diagram of the calculation part 240,244,248,252.

Drawing 7It is an example of the selection process of a quantizer.

Drawing 8It is an explanatory view of the relation of the code amount and target code quantity of quantizer Q_n and Q_{n-1} .

Drawing 9It is an explanatory view of the relation of the code amount and target code quantity of quantizer Q_n and Q_{n-1} .

Description of Notations

- 10: Input data
- 12: Quantization parameter judgment part
- 14: Quantization parameter
- 16, 26, 34, 42, 52: Quantization number Q_n
- 18: Initial insufficient data volume
- 20: The amount of initial excess data
- 22: Target code quantity
- 24, 32, 40, 48: Calculation part
- 28, 36, 44, 54: Insufficient data volume
- 30, 38, 46, 56: The amount of excess data
- 50: The quantization parameter before operation
- 58: Quantization parameter final controlling element
- 60: The quantization parameter after operation
- 62: Input data
- 64: Quantization parameter
- 66: Input quantity child-ized number
- 68: Quantizing part
- 70: Quantizer selecting part
- 72: Variable length coding section

74: Code amount integrating part
76: A actual code amount
78: Target code quantity
80: Subtractor
82: Code amount difference
84: Code judging part
86: Code judging result
88: Insufficient data volume input
90: The amount input of excess data
92: Changeover switch
94: Quantization number selecting part
96: Output quantity child-sized number
98: Insufficient data volume output
100: The amount output of excess data
110: Quantization parameter input
112: Selected quantization number Q_n
114: Insufficient data volume
116: The amount of excess data
118: Divider
122: Multiplier
126: Adding machine
130: Comparator
132: Changeover switch
134: Quantization parameter output
210: Large blocking part
212: Small block-sized part
214: Orthogonal transformation section
216: Quantizer
218: Code quantity calculation section
220: Quantizer selecting part
222: Variable length coding section
230: Input data
232: Quantization parameter judgment part
234: Quantization parameter
236, 242, 246, 250, 254: Quantization number Q_n
238: Target code quantity
240, 244, 248, 252: Calculation part
262: Input data
264: Quantization parameter
266: Input quantity child-sized number
268: Quantizing part
270: Quantizer selecting part
272: Variable length coding section
274: Code amount integrating part
276: A actual code amount
278: Target code quantity
280: Subtractor
282: Code amount difference
284: Code judging part
286: Code judging result
294: Quantization number selecting part
296: Output quantity child-sized number
310: A selected direction when a code amount is smaller than target code quantity
312: A selected direction when a code amount is larger than target code quantity
314: A selection course in case Q_6 is chosen

Drawing 1

For drawings please refer to the original document.

Drawing 3

For drawings please refer to the original document.

Drawing 5

For drawings please refer to the original document.

Drawing 8

For drawings please refer to the original document.

Drawing 2

For drawings please refer to the original document.

Drawing 4

For drawings please refer to the original document.

Drawing 7

For drawings please refer to the original document.

Drawing 9

For drawings please refer to the original document.

Drawing 6

For drawings please refer to the original document.

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